THE AVIAN FAUNA OF TWO COMPENSATION BASINS LOCATED IN WELSHPOOL.

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ABSTRACT

The avian fauna of two compensation basins located at the Welshpool Road and Roe Highway intersection in the suburb of Welshpool was surveyed over an 11 month period. Results suggest that these two basins support a large and diverse bird community.

INTRODUCTION

The primary function of compensation basins is to act as flood mitigation devices for the diversion of storm water run-off to reduce road flooding. The size of these basins is determined by the expected volume of run-off and the availability of road-reserve. Essentially, compensation basins are "fitted" in a limited area of land. They can also form part of larger storm water drainage systems by being interconnected by drains. Water regimes for these basins are variable ranging from permanent to ephemeral water. Some of these structures are vegetated to "beautify" the sites which involves the planting of exotic and or non-endemic species usually located so as to hide the view of the basin from roads and access paths. Management of these basins is usually restricted to maintaining access and water volume. The compensation basins fulfil current general definition of wetlands (Environmental Protection Authority, 1993).

This paper reports on the avian fauna observed at two such compensation basins to illustrate the degree to which compensation basins, if constructed as artificial wetland systems, can act as adjuncts to existing wetland systems in the Perth region.

STUDY AREAS AND METHODS

The two compensation basins are located at the Welshpool Road and Reid Highway intersection, Welshpool. There is a basin located at the north-east (WRN) and south-east (WRS) section of this intersection. The two basins were designed and constructed as wetland systems (Kirby, 1992). They are situated in an area surrounded by residential and industrial zones as well as semi-

rural lots. The areas surrounding these basin form part of the Palusplain (Semeniuk, 1987) with seasonally inundated flats.

These two are connected by storm water overflow drains which run under a major road (Welshpool Road). During summer the two water bodies are isolated. Both basins have a management plan which includes the planting of native species common to wetlands of the surrounding area (The Appropriate Technology Development Group Inc, 1994a). Twenty-one plant communities were considered for establishment involving 63 species ranging from trees and shrubs such as *Eucalyptus rudis* and *Melaleuca preissiania* to rush and sedge species such as *Baumea juncea* and *Isolepis cernua*. Many of these communities are still developing, while some areas have failed with little or no establishment of native vegetation. At WRS the tallest canopy community consists mainly of remnant *Melaleuca rhaphiophylla* bushland. Rush and sedges do exist on a seasonal basis with approximately 0.1lha observed by March 1997 (this estimate does not include the extensive reed beds forming on and around the island). The main rush and sedge species identified were *Typha orientalis, T. domingensis, Juncus pallidus* and *Bolboschoenus caldwellii*. Exotic weeds are common at WRN, including stands of Tree Lucerne (*Chamaecytisus palmensis*). Reed beds are better established at this basin with 5 of the 7 island seasonally covered in dense *Baumea* sp. and *Juncus* sp. thickets.

Two major habitats are present at each basin. The first is the basin itself (ie., the waterbody) and the second is the area surrounding the basins (ie., dryland habitats).

Each of these habitats required the application of different sampling methods (*cf.* Davies, 1984).

To sample the waterbirds using the basin a timed area search method was employed. This required the observer to move systematically around the basin over a specified time, identifying and counting individuals. This method assumes that there will be a point of "diminishing returns" where the observer is confident that all species in the area have been noted.

The surrounding habitats were sampled through timed random area searches for bushbirds. This required the observer to search the area noting details of bird species encountered.

In all cases a time limit was imposed to provide a systematic (ie., replicable) approach to the sampling regime. The total time allocated to fauna sampling was 40 minutes in each location. Sites were sampled each month from April 1996 to March 1997 in the morning and again in the afternoon.

The information gathered on observed birds included the number of individuals, their age, sex (if possible), and any breeding notes, which included the number of dependent young/eggs, nest location, breeding behaviour.

Important points to note in the preparation of data for use in this report are listed below:

By undertaking morning and afternoon surveys of fauna, the problem of "double-counting" of individuals arises (this is especially so for individuals who have taken up residence at these sites). This problem was rectified by only using the largest group size for any species observed from either morning and afternoon surveys during each sampling period. This subset of data was used for the calculation of diversity measures.

Birds were grouped into the categories of bushbirds, shorebirds (includes waders) and waterfowl (eg., divers, dabblers). A third group, designated water-birds, was created for species which are inextricably associated with wetland habitats but did not fit into either of the other categories (eg, Clamorous Reed-warbles, Little Grassbirds). Where possible the three categories associated with wetland environments were combined to provide a contrast to the bushbird group.

Measures of bird diversity were undertaken using the Shannon and Equitability indices (Krebs, 1989). The former index is a sum of the proportional values of each species found within the community, and, generally, higher values indicate greater diversity. This index should be considered in conjunction with the Equitability score, which measures the degree to which a species or a group of species dominate the community. This index has a range from 0 to 1 with increasing degree of evenness.

RESULTS

Fifty-two species were observed at each site over the study period (Table 1). Of the 52 bird species observed at WRN, 25 were classed as Bushbirds, 16 as Waterfowl, 10 as Shorebirds and 1 Water-bird (a single observation of a Little Grassbird).

The most abundant Bushbirds species were Welcome Swallows (124) and Laughing Turtle-doves (40). Four species of raptors were observed at this site (Brown Goshawk, Black-shouldered Kite, Brown Falcon and Australian Kestrel).

There were only small differences in the division of the 52 bird species observed at WRS. There were 25 species classed as Bushbirds, 18 as Waterfowl and 9 as Shorebirds. Of the Bushbirds, the most abundant species were Welcome Swallows (73) and Laughing Turtle-doves (51). Two large flocks of feral pigeons were observed in April and July 1996 but were scarce at other times. Of interest are the 5 species of raptors noted for this site (Collared Sparrowhawk, Black-shouldered Kite, Australian Hobby, Australian Kestrel and Peregrine Falcon). This is a relatively high diversity of these high-order carnivores for a single area.

The most abundant Waterfowl species observed at WRN were Eurasian Coots (143), Australasian Grebes (72), Pacific Black-duck (85) and Australian Shelduck (86). The first three of these species were present on all 11 sampling occasions with the greatest numbers observed in late summer

Table 1. Bird species observed at WRN and WRS over the 11 month sampling period. The total number of individuals observed over the years sampling are provided in parentheses. (Codes: X – Indicates presence of Species; I – Introduced Species; J – Species listed under the JAMBA international treaty; C – Species listed under the CAMBA international treaty; W – Species listed under Schedule 1 or 4 of the Western Australian Wildlife Conservation Act 1950 (1996 Notice).

Species Group	Species		WRN	WRS
Bushbirds	ACCIPITRIDAE			
	Elanus notatus	Black-shouldered Kite	X (2)	X (5)
	Accipiter fasciatus	Brown Goshawk	X (1)	
	Accipiter cirrhocephalus	Collared Sparrowhawk	X (1)	
	FALCONIDAE			
	Falco peregrinus	Peregrine Falcon (W)	X (1)	
	Falco longipennis	Australian Hobby	X (4)	
	Falco berigora	Brown Falcon	X (1)	
	Falco cenchroides	Australian Kestrel	X (4)	X (7)
	COLUMBIDAE			
	Columba livia	Feral Pigeon (I)	X (25)	X (52)
	Streptopelia senegalensis	Laughing Turtle-Dove (I)	X (40)	X (51)
	Streptopelia chinensis	Spotted Turtle-Dove (I)	X (8)	
	CACATUIDAE			
	Calyptorhynchus baudinii	Baudin's Cockatoo (W)	X (8)	
	Cacatua roseicapilla	Galah	X (2)	X (2)
	LORIIDAE			
	Trichoglossus haematodus	Rainbow Lorikeet (I)	X (2)	
	CUCULIDAE			
	Cuculus pallidus	Pallid Cuckoo	X (1)	
	ALCEDINIDAE			
	Dacelo novaeguineae	Laughing Kookaburra (I)	X (2)	X (1)
	MEROPIDAE			
	Merops ornatus	Rainbow Bee-eater (J)	X (1)	
	HIRUDINIDAE			
	Hirundo neoxena	Welcome Swallow	X (124)	X (73)
	Cecropis nigricans	Tree Martin	X (9)	
	MOTACILLIDAE			
	Anthus novaeseelandiae	Richard's Pipit	X (7)	X (12)
	CAMPEPHAGIDAE			
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	X (2)	X (4)
	MUSCICAPIDAE			
	Pachycephala rufiventris	Rufous Whistler	X (1)	
	Rhipidura fuliginosa	Grey Fantail	X (1)	
	Rhipidura leucophrys	Willie Wagtail	X (29)	X (40)
	ACANTHIZIDAE			
	Gerygone fusca	Western Gerygone	X (1)	
	MELIPHAGIDAE			
	Anthochaera carunculata	Red Wattlebird	X (2)	X (11)
	Anthochaera chrysoptera	Little Wattlebird		
	Lichenostomus virescens	Singing Honeyeater	X (24)	X (17)
	Lichmera indistincta	Brown Honeyeater	X (13)	X (3)

	ZOSTEROPIDAE			
	Zosterops lateralis	Silvereye	X (21)	X (6)
	GRALLINIDAE			
	Grallina cyanoleuca	Australian Magpie-lark	X (11)	X (22)
	CRACTICIDAE			
	Cracticus torquatus	Grey Butcherbird	X (6)	
	Cracticus nigrogularis	Pied Butcherbird	X (2)	
	Gymnorhina tibicen	Australian Magpie	X (22)	X (11)
	CORVIDAE			
	Corvus coronoides	Australian Raven	X (12)	X (6)
Waterfowl	PODICIPEDIDAE			
	Podiceps cristatus	Great Crested Grebe	X (1)	
	Poliocephalus poliocephalus	Hoary-headed Grebe	X (2)	X (6)
	Tachybaptus novaehollandiae	Australasian Grebe	X (72)	X (104)
	PHALACROCORACIDAE			
	Phalacrocorax carbo	Great Cormorant	X (1)	X (1)
	Phalacrocorax varius	Pied Cormorant	X (21)	X (13)
	Phalacrocorax sulcirostris	Little Black Cormorant	X (8)	X (20)
	Phalacrocorax melanoleucos	Little Pied Cormorant	X (29)	X (14)
	ANATIDAE			
	Cygnus atratus	Black Swan	X (7)	X (29)
	Tadorna tadornoides	Australian Shelduck	X (86)	X (32)
	Anas superciliosa	Pacific Black Duck	X (85)	X (148)
	Anas platyrhynchos	Mallard (I)	X (2)	X (28)
	Anas gibberifrons	Grey Teal	X (50)	X (34)
	Anas rhynchotis	Australasian Shoveler	X (18)	X (10)
	Aythya australis	Hardhead	X (28)	X (52)
	Chenonetta jubata	Maned Duck	X (42)	X (19)
	Biziura lobata	Musk Duck	X (7)	X (1)
	RALLIDAE			
	Porphyrio porphyrio	Purple Swamphen	X (1)	
	Fulica atra	Eurasian Coot	X (143)	X (216)
Shorebirds	ARDEIDAE			
	Ardea novaehollandiae	White-faced Heron	X (9)	X (12)
	Egretta alba	Great Egret (C, J)	X (1)	X (1)
	PLATALEIDAE			
	Threskiornis aethiopica	Sacred Ibis	X (194)	X (10)
	Threskiornis spinicollis	Straw-necked Ibis	X (11)	X (2)
	Platalea flavipes	Yellow-billed Spoonbill	X (5)	X (4)
	CHARADRIIDAE			
	Charadrius melanops	Black-fronted Plover	X (28)	X (23)
	RECURVIROSTRIDAE			
	Himantopus himantopus	Black-winged Stilt	X (58)	X (68)
	SCOLOPACIDAE			
	Tringa hypoleucos	Common Sandpiper	X (5)	X (6)
	Tringa nebularia	Greenshank (C, J)	X (2)	
	LARIDAE			
	Larus novaehollandiae	Silver Gull	X (239)	X (114)
Water-birds	SYLVIIDAE			
	Megalurus gramineus	Little Grassbird	X (1)	

and autumn. Silver Gulls (239) and Sacred Ibis (194) were the most abundant Shorebirds, although both of these were seen in large flocks on 8 and 5 sampling occasions respectively. Black-winged Stilts (58) were also abundant at this site and were present on all sampling occasions.

WRS again proved almost a mirror image to WRN in the distribution of species among the three categories associated with wetland systems. The most abundant Waterfowl species were Eurasian Coots (216), Pacific Black-duck (148) and Australasian Grebe (104). All three species were present on all 11 sampling occasions, with the greatest numbers observed in late summer and autumn. Silver Gulls were the most abundant of the Shorebirds, though Silver Gulls are a flocking species. Three large flocks of 36, 50 and 24 birds were noted on separate occasions during this study. Black-winged Stilts (68) were also abundant at this site and were present on all sampling occasions.

Diversity and Equitability indices for both bushbirds and the combined Waterfowl, Shorebird and Waterbird species at both sites did not differ greatly (Table 2). Equitability scores were relatively high at both basins suggesting that the bird communities in these areas were not dominated entirely by a small number of species.

There were differences in the abundance of these two groups and within the waterbird, shorebird and waterfowl group (Table 3). Generally, there were more individuals observed at WRN than WRS. More than twice the number of shorebirds were observed at WRN than for the same period at WRS. However, slightly more waterfowl were observed at WRS than WRN.

The use of these sites for breeding was more prevalent among the waterfowl and shorebirds. The waterfowl species observed breeding included Eurasian Coot, Australian Shelduck, Australasian Grebe, Grey Teal and Pacific Black Duck. The only shorebird species observed breeding was the Black-winged Stilt and both nests and

Table 2. Shannon diversity index and equitability scores for the bushbirds and combined Waterfowl, Shorebird and Waterbird species at the two basins.

Bush Birds	WRN	WRS
Shannon Index	1.04	1.10
Equitability	0.74	0.79
No. of species	25	25
Combined Group		
Shannon Index	1.10	1.10
Equitability	0.77	0.77
No. of species	27	27

Table 3. Abundance figures for bushbirds and combined Waterfowl, Shorebird and Waterbird species at the two basins.

	WRN	WRS	Total
Waterfowl	601	729	1330
Shorebirds	552	240	792
Waterbirds	1	–	1
Bushbirds	365	348	713
Total	1519	1317	2836

adults with young were sited over the study period. Most breeding observations for this species were from WRN.

DISCUSSION

In terms of bird movements the embankments and roads separating the two basins do not represent any real obstacle. These two basins essentially form the one wetland system.

These basins perform dual roles in providing storm water control and the establishment of wetland habitat as part of Main Roads Western Australia's Wetland Replacement Policy. These basins provide permanent water sites and have the potential to act as drought refuges.

The species list from this study is significantly larger than that obtained by The Appropriate Technology Development Group Inc (1994b) in a bird survey conducted soon after the establishment of the basins.

These two basins have been constructed to provide a variety of wetland habitats including mudflats/shallows, islands and reed beds. The northern basin (WRN) has a greater variety and a greater area of these particular habitats. This is reflected in the different abundance distributions for shorebird species which prefer these habitats. The presence of the 7 islets at WRN were of specific importance to Black-winged Stilts who used these as nesting sites.

There were more waterfowl found at WRS with Pacific Black Ducks, Eurasian Coots and Australasian Grebes dominating. This basin was also a preferred breeding site for waterfowl.

Both basins supported a diverse range of raptors (7 species). Remnant bushland and small reserves can be found in areas surrounding these basins which may provide sufficient habitat for these raptors.

The diversity of bushbirds is relatively low at these sites. Much of the revegetation is still in its early stages and there is a lack of tall trees. Dense shrub and undergrowth is limited to only a few small pockets. With continued development of these dryland habitats the diversity of bird species could increase to levels representative of natural wetland-bushland systems.

Grassed areas which encourage such species as Maned Ducks, Richards Pipit, Sacred Ibis and Magpies were present early in the study period. However, as a result of erosion control measures, the grassed areas were covered with wood chip. This, in turn, resulted in a drop in the numbers of these species.

This study has provided an insight into avian fauna use of compensation basins. These basins accommodate a diverse and abundant avian fauna community. However, it must be remembered that the basins described in this study are atypical of the structures more usually designed for storm water management. Continued monitoring of this site would provide an insight into the possibility of developing such basins as inner city wetland systems which can

support a varied fauna community.

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